REMARKS

The office action of December 2, 2004 has been reviewed and its contents carefully noted. Reconsideration of this case, as amended, is requested. Claims 1 through 7 and 9 through 23 remain in this case, claim 8 being cancelled, and claims 12 through 24 being added by this response. No new matter has been added.

Claim 7 was amended based on page 4, lines 16-21. Claim 9 was amended based on page 4, lines 22-29. No new matter has been added.

The specification has been amended to clarify the example on page 5. The amendment is supported by page 4, lines 22-28 and Figure 1. No new matter has been added.

Exhibit A is enclosed with this response.

Rejection(s) under 35 U.S.C. §103

Claims 1-11 were rejected under 35 U.S.C. 103(a) as being unpatentable over Kosco (USPN 6,338,747) in view of Baran et al ("Silicon Containing High Performance Alloys Machinability and Mechanical Properties") and Sonti et al. (US 2004/0219051). Applicant respectfully disagrees.

In Kosco, a metallurgic powder is compacted at a pressure between 20 to 70 tsi, heated to 2000°F to 2400°F for 15 to 120 minutes, and then cooled at a rate no greater than 60°F per minute to room temperature, to ensure that the compact may sufficiently mechanically worked. Then, the compact is deformed to increase the density. After densification, the compact is heated again to 2050°F-2400°F and cooled at a rate of 160°F - 400°F/min to room temperature. A secondary operation of tempering or quenching may follow. The densification in Kosco increases the surface area of a portion of the surface by mechanical working.

The Examiner states, "Kosco further discloses wherein the forming a densified portion includes hot forming at a temperature of 1800°F for 3 minutes (see Example 2), in the temperature limitation of Applicant's step d) but for less time. The Examiner finding that the time limitation of a small part such as a race would lead to total heating of the part, resulting in

the same desired effects as claimed." Referring to Applicant's claim 1 and 10, step d) refers to "cooling the compact at a rate of 10°F to 120°F" and "cooling the compact at a rate of 25°F per minute" respectively. Applicant asks the Examiner for clarification as to which step in the claims he is referring to.

Baran et al. discusses the advantages of including silicon in powder metal powder to increase hardenability, elongation, and tensile strength when coupled with densification. Baran et al's densification is achieved through high temperature sintering, without mechanical working.

In Sonti et al., the prior art discusses US 5,711,187, which discloses a method of forming a powder metal gear wheel from a pressed and sintered powder metal blank that has undergone sintering and densification is described as needing subsequent hard finishing by grinding after densification, and hardening has taken place as described in paragraphs [0007] to [0009]. The grinding discussed in the prior art is specifically for increasing the accuracy of the teeth of the gear wheel and only removes 150 microns of densified surface region of the teeth.

The actual invention described by Sonti et al. describes a workpiece that is prepared for thermo-mechanical working or ausforming. Specifically, the workpiece is formed with its gear teeth oversized in tooth thickness relative to the final size so the gear meets dimensional tolerances **without the necessity of grinding** as stated in paragraph [0050] and [0083]. Sonti et al. teaches away from performing grinding.

The combination of Kosco in view of Baran et al. and Sonti et al. results in a metallurgic powder containing silicon that is compacted between 20 to 70 tsi, heated to 2000°F to 2400°F for 15 to 120 minutes, and then cooled at a rate no greater than 60°F per minute to room temperature to prepare the compact for surface densification. Then, the compact is deformed to increase the density. After densification, the compact is heated again to 2050°F-2400°F and cooled at a rate of 160°F - 400°F/min to room temperature, with a secondary operation of tempering or quenching. After the part is quenched and then tempered, grinding is performed to increase the accuracy of the teeth.

The combination of Kosco in view of Baran et al in view of Sonti et al. does not teach or suggest Applicant's invention. Applicant's claim 1 states the steps of:

"a) providing a metallurgic powder;

"b) compressing the metallurgic powder at a pressure of 30 to 65 tons per square inch to provide a compact;

"c) heating the compact to 1400°F to 2000 °F for 20 to 60 minutes;

"d) cooling the compact at a rate of 10°F to 120 °F per minute;

"e) grinding the compact to produce a detailed surface geometry;

"f) heating the compact to 2000 °F to 2400 °F for 20 to 80 minutes;

"g) cooling the compact at a rate of 120 °F to 450 °F per minute; and

"h) heating the compact to 300°F for 30 to 90 minutes."

Densification does not occur in Applicant's method. The combination of Kosco in view of Baran et al. in view of Sonti et al., teaches that densification is always required prior to any type of grinding that occurs. As shown in claim 1, all grinding in Applicant's invention takes place after the compact has been heated and cooled and without densification.

Applicant's claim 6, dependent on claim 1, states, "The method of claim 1, wherein the grinding in step d) is form grinding or profile grinding." Form grinding/profile grinding is defined in the application as utilizing super-abrasive tools to generate profiles and detailed geometry, such as multiple rows of teeth and undercut, which are difficult to make by conventional powder metal compaction methods and single point machining (see page 4 lines 16-21). In the combination of Kosco, Baran et al., and Sonti et al., grinding is discussed only in Sonti et al. and is specifically attributed to prior art reference US 5,711,187, which discloses a method of forming a powder metal gear wheel from a pressed and sintered powder metal blank that has undergone sintering and densification. The inventors of the Sonti et al. state that additional or subsequent hard finishing by grinding after densification and hardening is needed for increasing the accuracy of the teeth of the gear wheel and only removes 150 microns of densified surface region of the teeth. The grinding that takes place can not form multiple rows of

teeth and undercut because the teeth of the gear wheel are already present and the grinding is only to increase the accuracy of the teeth.

Referring to enclosed exhibit A, the grinding used in Applicant's invention and the grinding used in Sonti et al. is shown. Applicant starts off with a cross-section of a sprocket that only has a whole row of teeth. After profile or form grinding has taken place, profiles and detailed geometry, such as multiple rows of teeth, an undercut, and other complex shapes may be made. The shapes are not limited to those shown in the Exhibit. Sonti et al. starts with a tooth already present and is indicated by the solid line. After grinding has occurred, shown by the dashed line, only 150 microns of the densified surface region of the teeth has been removed. The grinding in Sonti et al. only increases the accuracy of the teeth of the gear wheel and does not form detailed geometry, such as multiple rows of teeth, an undercut, and other complex shapes.

Applicant's claim 10 states:

"a) providing a metallurgic powder;

"b) compressing the metallurgic powder at a pressure of 45 tons per square inch to provide a compact;

"c) heating the compact to 1650°F for 30 minutes;

"d) cooling the compact at a rate of 25°F per minute;

"e) grinding the compact to produce two rows of teeth with a groove in between the two rows;

"f) heating the compact to 2070 °F for 30 minutes; and

"g) cooling the compact at a rate of 150°F per minute."

The combination of Kosco in view of Baran et al. in view of Sonti et al. does not teach or suggest step c) of heating the compact to 1650°F for 30 minutes, or step e) "e) grinding the compact to produce two rows of teeth with a groove in between the two rows." Kosco, Baran et al, nor Sonti et al. do not suggest or teach heating of the compact in any of the examples to less

than a temperature of 2000°F . Applicant's step c) heats the compact to a temperature of 1650°F for 30 minutes.

Kosco, Baran et al, nor Sonti et al. disclose step e), grinding the compact to produce two rows of teeth with a groove in between the two rows. As stated earlier, Sonti et al. discloses " subsequent hard finishing by grinding," after the powder metal gear wheel and any teeth have been formed and is suggested by the inventors of Sonti et al. to improve the accuracy of the formed gear after the teeth have already been cut.

Furthermore, as stated above, densification does not occur in Applicant's method. In the combination of Kosco in view of Baran et al. in view of Sonti et al., teaches that densification is always required prior to any type of grinding that occurs. As shown in claim 10, all grinding in Applicant's invention takes place after the compact has been heated and cooled and without densification.

Applicant's claim 14 states:

"a) providing a metallurgic powder;

"b) compressing the metallurgic powder at a pressure of 30 to 65 tons per square inch to provide a compact;

"c) heating the compact to 1400°F to 2000 °F for 20 to 60 minutes;

"d) cooling the compact at a rate of 10°F to 120 °F per minute;

"e) grinding the compact to produce a detailed surface geometry, without substantial densification;

"f) heating the compact to 2000 °F to 2400 °F for 20 to 80 minutes;

"g) cooling the compact at a rate of 120 °F to 450 °F per minute; and

"h) heating the compact to 300°F for 30 to 90 minutes."

Densification does not occur in Applicant's method. The combination of Kosco in view of Baran et al. in view of Sonti et al., teaches that densification is always required prior to any type of grinding that occurs. As shown in claim 14 all grinding in Applicant's invention takes place after the compact has been heated and cooled and without densification.

Applicant's claim 23 states:

"a) providing a metallurgic powder;

"b) compressing the metallurgic powder at a pressure of 30 to 65 tons per square inch to provide a compact;

"c) heating the compact to 1400 °F to 2000 °F for 20 to 60 minutes;

"d) cooling the compact at a rate of 10 °F to 120 °F per minute;

"e) grinding the compact to produce the detailed surface geometry of two rows of teeth with a groove in between the two rows without substantial densification;

"f) heating the compact to 2000 °F to 2400 °F for 20 to 80 minutes; and

"g) cooling the compact at a rate of 120 °F to 450 °F per minute."

Kosco, Baran et al, nor Sonti et al. disclose step e), grinding the compact to produce the detailed surface geometry of two rows of teeth with a groove in between the two rows without substantial densification. As stated earlier, Sonti et al. discloses " subsequent hard finishing by grinding," after the powder metal gear wheel and any teeth have been formed and is suggested by the inventors of Sonti et al. to improve the accuracy of the formed gear after the teeth have already been cut.

Furthermore, as stated above, densification does not occur in Applicant's method. In the combination of Kosco in view of Baran et al. in view of Sonti et al., teaches that densification is always required prior to any type of grinding that occurs. As shown in claim 23, all grinding in Applicant's invention takes place after the compact has been heated and cooled and without substantial densification.

Therefore, it is respectfully suggested that the rejection of independent claim 1 and 10 as being anticipated by Kosco in view of Baran et al. and Sonti et al. is overcome. Dependent claims 2 through 9 and 11 through 13, being dependent upon and further limiting independent claims 1 and 10, should also be allowable for that reason, as well as for the additional recitations they contain. Reconsideration and withdrawal of the rejection are respectfully requested.

Applicant also believes that newly added claims 12 through 24 are in condition for allowance.

Conclusion

Applicant believes the claims, as amended, are patentable over the prior art, and that this case is now in condition for allowance of all claims therein. Such action is thus respectfully requested. If the Examiner disagrees, or believes for any other reason that direct contact with Applicants' attorney would advance the prosecution of the case to finality, he is invited to telephone the undersigned at the number given below.

"Recognizing that Internet communications are not secured, I hereby authorize the PTO to communicate with me concerning any subject matter of this application by electronic mail. I understand that a copy of these communications will be made of record in the application file."

Respectfully Submitted:
Xu et al.

By:_____

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